Welcome to Psy 652 Lab!

Module 8:

Matrix Algebra & Multivariate

Correlations

Objectives

Matrix Algebra

Indexing from a Matrix

Multivariate Correlations

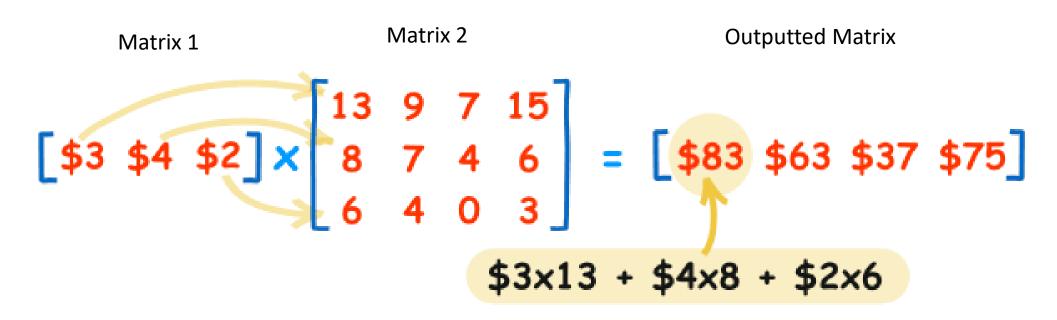
Matrix Algebra

Matrix algebra

- Today we will be working with matrices in R
- A matrix is a 2-dimensional array of numbers.
 - In R, a matrix requires that all your data take on the same type of class (i.e. character, numeric or logical).
 - This is what separates it from a data frame Which allows values of any class to be together
- Today, we will be using matrix algebra to obtain a multivariate correlation (A correlation with multiple X's and Y's)

$$R_{CxCy} = \frac{w_x R_{xy} w_y'}{\sqrt{w_y R_y w_y'} \sqrt{w_x R_x w_x'}}$$

How does matrix algebra work?



- Each bracket is a matrix
- Notice how we multiply a 1x3 matrix by a 3x4 matrix.
 - This spits out a 1 x 4 matrix. Order matters in matrix multiplication
 - You need the # of columns in matrix 1 to match the # of rows in matrix 2.
- We will be using this method to obtain the multivariate correlation (Equation on top right)

Indexing Variables from a Matrix

Indexing Variables from a matrix

- Today we will be "indexing" variables from a matrix
- This is equivalent to "selecting" (via select()) and filtering (via filter()) variables in a dataframe
- However, we are working with a matrices and select()/filter() won't work on matrices.
- Instead, we need to tell R which variables we want with brackets "[,]"
- Indexing works as so:
 - Matrix_name[rows, columns]
 - To the left of the comma are all of the rows you want to filter to. To the right of the comma is all
 of the columns you want to select.
 - I provide examples on the next slide

Some examples

Matrix_name[2,3]

Takes the second row and the third column of your matrix

Matrix_name[,3]

Takes every row from the third column (blank spaces before a comma indicate "Take it all")

Matrix_name[3,]

Takes third row and every column

Matrix_name[1:3,2:4]

• A colon indicates, "here to there". This matrix takes rows 1 to 3 and columns 2 to 4.

Matrix_name[1:5,]

Takes rows 1 to 5 and every column.

```
> m
      [,1] [,2] [,3] [,4]
[1,]      8      1      3     6
[2,]      5      12      9     10
[3,]      11      15      14      2
> # Selecting the 3rd row
> m[3,]
[1] 11 15 14      2
>
> # Selecting the 3rd column
> m[,3]
[1]      3      9      14
```

Some notes

- Indexing can also be done on dataframes and is quite efficient.
 - But select() and filter() are much more intuitive!
 - So keep using those!
- We won't be using it much in this class! Mostly just this module!

Multivariate Correlations

Multivariate correlation

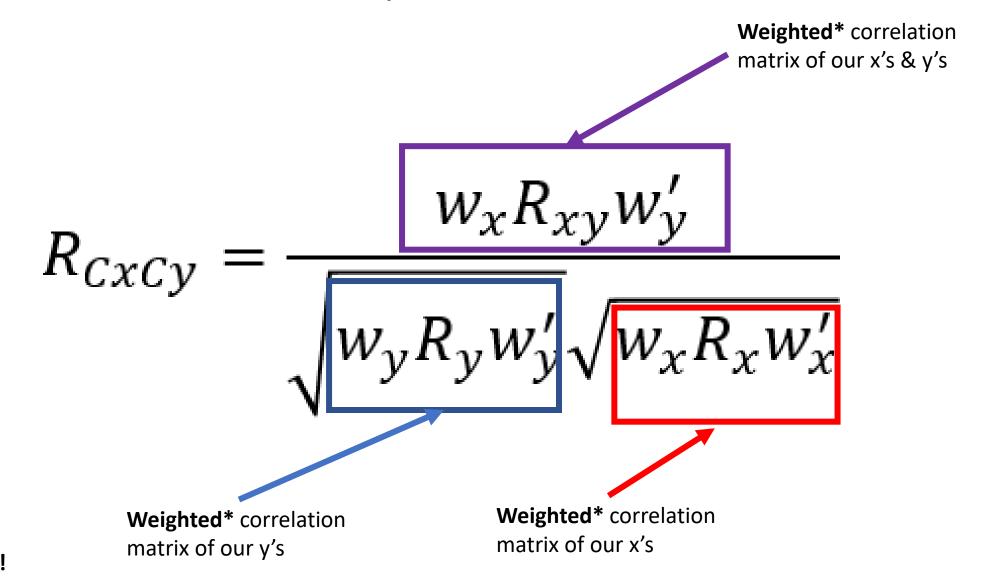
- The correlation of 3+ variables
- The goal of today will be to find the multivariate correlation of a series of X's (Predictors) and multiple Y's (Outcomes/Criterions)

- Additionally, We will learn how to weight variables
 - Weighting variables indicates which variables are of more important in your study.

The Multivariate Equation

$$R_{CxCy} = \frac{w_x R_{xy} w_y'}{\sqrt{w_y R_y w_y'} \sqrt{w_x R_x w_x'}}$$

The Multivariate Equation



* The weight is chosen by **YOU!**

Let's code!